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MECHANICAL HARVESTING OF CHERRIES

The Results Obtained in 1962 are Promising

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A PANEL DISCUSSION

Conducted by

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GASTONS: For the past several years I have presented progress reports on mechanical picking at the annual meetings of the Michigan State Horticultural Society. On these occasions I have discussed the results of the cooperative studies being conducted by Michigan State University and the U. S. Department of Agriculture. More and more growers are becoming interested in mechanical harvesting, and the committee that set up the 1962 program asked me to appear again this year to discuss the results of last season's cherry harvesting studies. Before doing so I am going to provide perspective by reviewing briefly the work done in previous years.

Our trials were begun in 1956, and by the end of 1959 the basic principles of mechanical picking had been worked out. By this I mean that the experimental work had proved (1) that cherries could be successfully separated from the tree by means of mechanical shakers, (2) that the separated fruit could be caught in under-the-tree collecting units, (3) that the fruit collected in this way could be transferred without excessive mechanical injury to containers in which it could be moved to processing plants, (4) that the total cost of these operations was less than that of conventional picking, and (5) that machine-picked fruit was of a quality that could be successfully processed.

Although the basic principles of mechanized picking had been established, reliable machines capable of performing all of the necessary steps involved, had not as yet been developed. However, growers were so anxious to take advantage of methods that promised to lower costs and reduce the number of workers required, that they began using picking machines even though the effectiveness of the equipment had not yet been proven.

Unfortunately many of the picking machines used in 1960 and 1961 ran for only a short time before breaking down. Much of the equipment was not only unreliable but also caused mechanical injury to the tree and to the fruit. The latter type of damage lowered grade and increased the amount of sorting that was necessary.

Although most growers and processors felt that mechanization was inevitable, almost everyone concerned came to realize that better equipment would have to be developed before picking machines would come into wide-spread use.

Better and more reliable equipment was developed during the winter of 1961-62 and made available during the early part of the latter year. A number of growers provided themselves with these machines almost at once, and announced their intentions of using them throughout the harvest season.

Practically all lots of machine-picked cherries contain leaves, twigs, stems and other foreign material which must be removed before the fruit can be moved into processing lines. The cull cherries, at least some of which are either discarded or left on the tree by competent human pickers, are separated by mechanical shakers and collected along with the unblemished fruit. Such cherries must be sorted out if acceptable finished product grade standards are to be maintained. The elimination of twigs, leaves and abnormally large percentages of cull cherries poses problems which the cherry industry has never before been called upon to solve.

When the research group which I represent learned, as they did in the spring of 1962, that Michigan growers planned to harvest more than 1,000 tons of cherries with machines, we decided that the time had come to make comprehensive studies which would:

1—make it possible to define the cleaning and sorting problems which are associated with the processing of machine-picked cherries,

2—assist in developing equipment and methods of cleaning, de-stemming and sorting fruit of this type, and

3—determine the costs of cleaning, de-stemming and sorting machine-picked cherries under present conditions of processing.

In an effort to find the answers to these and related problems, large-scale studies were made in each of the three major cherry producing areas of Michigan. The cooperation of four commercial processing plants was enlisted, and detailed records were kept on the cleaning, sorting and processing of 55 tons of machine-picked cherries, and on more than 33 tons of hand-picked fruit. Cherries from six orchards were included in the trials and 20 test runs, (made up of from 4,000 to 12,000 pounds of cherries) were studied.

The data obtained should prove useful to the cherry industry in working out the new standards and procedures which will have to be developed before machine picking can become an accepted commercial practice. Although we do not have time for a detailed presentation of our findings, a brief summary of the sorting cost and yield data will give you an idea of how the figures can be used.

If we select only those samples in which a sufficient number of defective cherries were sorted out to give a processed product of grade A, we find that the average direct labor costs of cleaning and sorting the machine-picked cherries were approximately $3.00 per ton more than for hand-picked fruit. The data also indicate that, on the average, machine-picked fruit yielded about 3 percent less finished product of grade A than comparable lots of hand-picked fruit. In 1962 cherrries brought 5 cents per pound, and a 3 percent reduction in yield meant that per-ton returns were $3 less. When we added this figure to the $3 sorting cost, we arrived at a total of $6 per ton. These figures mean that, from the processors' point of view, last season's machine-picked cherries were worth about $6 per ton less than hand-picked fruit. The exact figure in a particular case would depend on the per pound price of the fruit, sorting costs at the plant involved, the

yield and grade obtained and other factors which will have to be taken into account when mechanization becomes standard practice. If this additional processing cost is viewed in the light of the $30 to $40 per ton decrease in harvesting costs brought about by the mechanical harvesters, a significiant over-all savings to the cherry industry becomes apparent.

Returns to the cherry grower were relatively low last season, and producers would probably have been understandably reluctant to take less for their fruit. However, growers who increase net returns by mechanizing should be willing to do the additional cleaning and sorting involved or pay someone else to perform this service. The reader should also bear in mind the fact that the figures presented above were obtained in studies of the methods and equipment used in 1962. It is hoped that improvements in equipment and techniques will lower sorting costs in the years to come. Plans are being made to try electronic sorting machines and mechanical destemmers during the coming season. It is hoped that this equipment will increase the rate at which the sorting lines can be operated, and reduce the cost of doing the work.

Our processing studies of 1962 reflect a cross-section of the Michigan cherry industry as it existed at the time; C grade as well as A grade cherries were included. The results, which should interest both growers and processors, are summarized in the following Table:

TABLE 1: *Machine-Harvested and Hand-Harvested Cherries compared on the Basis of their Processing Characteristics*

FACTOR	MACHINE-HARVESTED			HAND-HARVESTED		
	No. of Tests	Average	Range	No. of Tests	Average	Range
Cherries processed	12	4.6 tons	2.1-6.3 tons	8	4.1 tons	1.7-6.0 tons
Raw product grade U.S. No. 1	38	89.3%	85.0-93.5%	20	91.8%	88.0-95.5%
Cherries with stems attached	38	2.9%	1.0-4.5%	20	0.5%	0.0-1.5%
Defective cherries (excluding stems)	38	7.8%	3.5-14.0%	20	7.7%	4.5-11.5%
*Soft bruised cherries	20	8.3%	4.0-14.1%	4	4.8%	2.5-7.4%
Pounds of cherries per minute per sorter	12	7.9 lb.	3.4-21.6 lb.	12	9.8 lb.	6.8-16.9 lb.
Slow-down of sorting line	12	17.3%	0.0-52.0%	.....	.....	.....
Cost of sorting one ton of cherries	12	$9.48	$7.65-22.08	8	$7.65	$4.41-11.01
Pick-outs	10	4.8%	2.4-7.5%	7	3.6%	1.4-5.8%
Yield of pitted cherries	12	82.3%	76.8-86.2%	8	82.9%	78.4-86.2%
Grade Score, frozen and canned	35	90.9	85.3-97.0	18	90.6	86.0-95.5
Grade, frozen and canned	35	57% A	C - A	18	70% A	C - A

*In three of the test orchards machine-picking caused no more soft brusing than hand-picking. In the other three test orchards, machine-picking caused considerably more soft bruising—soft bruising is not a scorable defect.

The committee which arranged this year's program felt that while you would be interested in the results of the test runs of mechanically harvested fruit, you would also like to hear from some of the growers and processors who are taking an active part in the development of this new approach to the cherry harvesting problem. We have with us on the platform this morning a grower, two processors and a food technologist. I am sure that you will be interested in what these gentlemen have to say on the subject of harvest mechanization and how it affects cherry sorting and processing.

The decision to harvest our 1962 red tart cherry crop mechanically was made after a great deal of careful thought. This decision must be faced by other cherry growers located in areas where production is concentrated and a number of crops, which draw on the same labor force, are being harvested simultaneously. The assistance received from those who are pioneering machine harvesting has helped us decide what to do. The information that has been made available should also prove useful to other growers.

Our dwindling harvest labor force has become quite unpredictable, and demands an ever increasing portion of our operational dollar. When human pickers are used, more than half of the total cost of production often goes to pay for harvesting. Considering the young plantings still to reach full production and the trend toward higher costs, growers are being forced to develop methods that will reduce expenses. We must continue to grow and deliver cherries of high quality, and we cannot expect hand pickers to work for less money.

In our case we did not have the housing and equipment that we would have needed to pick the crops which we expect to produce in the near future. We needed additional laborers only for the harvesting of cherries, and investing in additional housing, ladders, pails and other equipment would have required an additional outlay which we could ill afford. This is the basic reason why we chose to invest in machines.

It is also true that some of the equipment (the tree shaker) can be used for thinning peaches and apples, of which we have a considerable acreage. The machines can also be used in harvesting sweet cherries, prunes and possibly pears, apricots, cling peaches and apples.

Our machines were used in harvesting approximately 200 tons of cherries during the 1962 season; 110 tons of this fruit were grown on our farm; 30 tons were harvested for a neighbor and approximately 60 tons were picked in the Traverse City area. Approximately 90 tons of the cherries grown in our orchards received an average grade of 91. Twenty tons harvested at the end of the season were sent to the juice plant because of poor quality.

During processing, approximately 3.6 tons of the 90 tons harvested in our orchards were sorted out and discarded. We received no payment for this fruit, but I feel that if we had picked the same crop by hand most of the defective cherries would have been sorted out by the pickers. Stems and limb-rubs were scored most often; the mummies, twigs and leaves that come from the trees were not scored by the men who did the grading. The amounts varied and will, I believe, decrease from year to year if we continue to "shake." Furthermore, the procedures of hauling the fruit in water will help the trash problem as well as the condition of the fruit. To a great extent the quality and condition of the cherries after separation depends on the equipment used and the management and supervision during the harvest operation.

In the future it may be necessary for processors to make arrangements to do the additional sorting. I doubt if it can be done effectively in the field. More in-the-plant sorting will have to be done if processors are to

put up large quantities of machine-picked cherries that will meet A-grade standards. Plant sorting will also avoid double handling which, in my opinion is undesirable.

I would like to conclude my remarks by presenting some cost figures in which I think you might be interested. On the average we picked about 12 trees and approximately 1,000 pounds of fruit per hour. Our per-hour labor cost was $8 which meant that our per pound labor cost was approximately 8/10 cent.

The net cost of our equipment (which included two shakers, a self-propelled collecting unit and a hand-operated deflector) was approximately $7,500, and when this amount is charged off over a three-year period, we arrived at an annual cost of $2,500. When we add to this figure, storage $100; interest $420; maintenance $300; fuel $100; and insurance $80 we arrive at a total of $3,500. This means that the per-pound cost of owning and operating our equipment was 9/10 cent per pound of fruit harvested. When we add the 8/10 cent labor cost and 9/10 cent operating cost, we get a total of 1.7 cents per pound. Although this figure is higher than others I have heard, we know that it can be done for this amount and that it is cheaper than hand-picking. We hope that the equipment will last for more than three years, and that experience will enable use to operate more efficiently; but I thought you would be interested not so much in what we hope to do as in what we did do this season.

I had the privilege and pleasure of addressing this group two years ago. Since my subject needed a title, I called it "Cherry Industry Problems Created By Mechanical Harvesting." I haven't changed my mind much in two years' time; the same problems still exist but fortunately solutions are being developed.

Labor difficulties are increasing for the grower; rather than the near future holding the promise of improvement, it appears that labor problems may go from bad to worse. The fruit grower cannot expect to undertake the battle of labor availability and administration of labor policies and still remain solvent. It is understandable then why most progressive growers are in a ready frame of mind to adopt mechanical harvesting.

I have never yet heard a grower say that he was going into mechanical harvesting because of his desire to deliver higher quality cherries. His main reason to "shake" is long-range survival in the industry. Shaking cherries can be classified with other developments of this missile age. It's a new science and in order to get into orbit we must go into training.

As basic training for this occupation, I offer the following as a definition: "The Mechanical Harvesting of Cherries is that method of harvest by which the fruit is separated from the tree, at a date nearly approximating normal harvest, by the application of rapidly vibrating forces to the trunk or limb. Further, this falling fruit is collected and conveyed or transferred to a transport container in which it remains until delivered to the receiving station or packing plant."

At this point I could spend time telling about performances of machines that harvest no less than a ton per hour at a cost of less than 1 cent per pound with a crew of 6 or 7 men—at an equipment cost of about $10,000. That would make a nice little talk to encourage mechanical harvesting, but at the same time it would indirectly be promoting a premature and undesirable change in our cherry industry. In certain years, depending on the weather, packers would be unable to pack better than C grade or sub-standard grade cherries, or else the wine or juice industry would take over all the product.

Since this is not the industry's goal, I would like to use my time to point out some of the troubles you can get into. I hope to be successful in my aim to suggest solutions to the problems I bring up.

I have selected the main points of the foregoing definition to use as dicussion subjects. They are, in the order of their appearance:

1. Fruit separated from the tree
2. Date of harvest
3. Vibrating forces applied to trunk or limbs
4. Falling fruit, collection, conveyance and storage in transport container.

1. *Fruit Separated from the tree.* Hand-picking methods enable growers to judge picker performance and obtain a fairly high degree of sorting service for the standard picking fee. Conscientious pickers discard such on-the-tree defects as wind whip, limb rub, under-color, under-size, and remove stems from those cherries with stems attached. This human touch is missing from mechanical harvesting. A shaker releases all cherries vibrated sufficiently, whether good or bad. The extremely heavy flow of fruit over a short period of time makes it very difficult for the grower to do much orchard sorting.

   I would advise then, as a solution to this problem, the following practices:

   A. Plant orchards in protected sites or provide wind protection for existing blocks.

   B. Prune and fertilize to produce uniformly sized and colored fruit throughout the tree.

   C. Encourage the Horticulture Department to develop practices and varieties that will produce hardier fruit that will withstand the effects of wind and weather and the wear and tear involved in mechanical harvesting and bulk handling. Plant breeders have been successful in similar efforts in the tomato industry.

   Until this can be achieved, shakers will be scored heavily for the defects included in their fruit, and packing plants will be overloaded with lower quality fruit. This affects both the grower and packer where it hurts the most—in the pocketbook. The packer will either pack below A grade or add to his investment in sorting facilities and increase his operating expense in labor in order to stay in A grade. More on this a little further on.

2. *Date of Harvest.* This point requires but brief comment. Past

experiences indicate that for economic release of fruit, shaking should be done about a week after hand-picking would normally start. This timing also reduces the incidence of attached stems. This can be called "a new way of life" for shakers.

3. *Vibrating forces applied to trunk or limbs.* Mechanical harvesting equipment has been improved to the point that very little apparent bark damage is inflicted. An aid to this good performance is the practice of pruning the tree to 2 to 3 nearly upright scaffold branches to permit right-angle attachments.

4. *Falling fruit, collection, conveyance, and storage in transport container.* From here on, my discussion deals with those treatments and actions of cherries that are unusual and peculiar to mechanical harvesting.

A normal cherry is fairly firm during its immature stage, but as it ripens it becomes less firm until it goes past its prime. After that time dehydration begins and the fruit regains firmness to the point of shriveling. Modern organic fungicide programs may promote an even lighter colored, larger, softer fruit with higher moisture content and lower soluble solid content. It's asking for real quality trouble to harvest this type of fruit during periods of high temperature, by shaking it loose from its attachment, dropping it as much as 12 feet, having it collide with branches, other cherries, the shaker boom, and finally land on the catching frame surface. If it "pockets" there or is handled too roughly in being conveyed into the lug or the water tank, chances are good that the sum total of all these actions will bruise the tender cherry. Even if an operator persists in using poor equipment, he can be at least partially saved by using fresh cold water in his tank. Lugs are out unless they go into a chiller. Prompt chilling seems to promote the healing action, to moderate bruising and result in a firmer cherry. Scalded cherries result in leach loss in the firming tank, loss of color and firmness after storage, heavy pick-out for grade, increased pitter loss, and reduced drain weight. Scald due to unhealed bruising is a hidden defect because most raw fruit inspectors will not interpret bruising as a scorable defect unless it be so severe as to be classified as lug scald or mutilation.

Dr. Bedford will probably later discuss his test work with comparative quality of hand-picked and shaken cherries. Our plant in Bailey was one of a group participating in test work to evaluate comparative costs in producing A-grade product from both hand-picked and shaken cherries. Studies of the yet unpublished data indicate the following:

To pack A-grade from shaken cherries as compared to hand picked the plant operations must (1) slow down to the point at which sorting costs average 58% higher, (which raises packing costs and reduces plant capacity); (2) increases pick-outs and pitting losses causing a 3% reduction of finished product. Included in the series of runs was one tank of cherries harvested at night. In that case, while not as good as hand-picked, results indicated improvement over daytime harvesting. This seems to suggest that shaker cherry quality improves with night-time operation.

An exciting development in the field of wet electronic sorting machines holds great promise for the entire cherry industry. I witnessed a pilot trial of this machine in Wisconsin during last pack season and I admit that

it could become a very necessary piece of equipment for packers receiving shaken cherries. When properly operated it does not tire, does not occupy much plant floor area, and it delivers a constant pre-set quality to the pitters. Annual charges are high but the payout may be realized in a normal season.

On this optimistic note I pledge that Cherry Growers, Inc., as a representative cherry packer, is willing to team up with research groups such as the U. S. D. A. and M. S. U. Horticultural Department, along with the growers to develop this new skill of mechanical harvesting to its ultimate aim of high fruit quality and reduced production costs.

OUR EXPERIENCES IN PROCESSING MECHANICALLY HARVESTED CHERRIES IN 1962

By WILLARD BURNETTE, *Burnette Farms Packing Company*
Hartford, Michigan

In conjunction with two of our tart cherry growers we received and processed mechanically harvested cherries in 1962. It was by accident rather than by design that the on-the-tree condition of the raw fruit at harvest was below normal. These same tart cherries would normally have been at the peak of condition for picking, either mechanically or by hand.

The cherries were mechanically harvested with a Friday Shaker and hand-catching frames of the growers' own design, (covered with Saran Fabric energy absorbing material,) emptied into regular cherry lugs and delivered to the plant within one hour. No attempt was made to field sort cherries except that a few leaves and twigs were picked off the tops at the lugs.

On arrival at the plant they were graded by U. S. D. A. standards and had a raw product grade of 89 percent on July 11 and 85 percent on July 14. The comparison with hand-picked cherries on the same days out of the same orchards was 88 percent and 92 percent. No attempt was made by the pickers to sort the cherries.

At this point I would like to point out a very interesting fact, as it does have a great deal of effect on the in-plant sorting of cherries and the effect on the final grade of cherries, canned or frozen.

In the mechanically harvested cherries there was a large amount of dried or partially dried cherries from the tops of the trees, as a result of wind whip and limb rub, whereas the hand-picked cherries contained only a minimum amount. The hand picker, even though not attempting to sort cherries, does not pick many dried up cherries, although he will pick one which has one side damage. The interesting part as to raw product grade is this: in a 500 gram sample there can be 4 to 7 of these dried cherries, but they deduct only 1 to 3 percent from the grade, whereas if these were normally defective cherries they could have deducted from 4 to 5 percent of the final grade.

We also found in the raw product grade for the mechanically-harvested cherries an average of 3.2 percent attached stems as compared with only ½ percent stems in the hand-picked. More about all this later on.

The cherries were "tanked" and held in 55° F. water from 20 to 21 hours before they were run. We followed regular procedure in running these cherries over the sorting belts and to the pitters.

We did experience a 14 percent slow-down on July 11 and 52 percent on July 14. We think the 14 percent slow-down was more nearly normal as we caused the slow-down by running them out of the tanks rather than by slower sorting.

Now we will go back to the dried cherries and the stems on cherries. We particularly noticed that the women on the belts would pick out the completely dried-up cherries and the cherries with stems which were very obvious. But when doing this, especially when picking stems off cherries, they would invariably let twice as many badly defective cherries go by. Also the machine-harvested cherries did change in appearance in the holding tanks. They seemed to darken and have a waxy, oily appearance. This was noted by everyone, plant personnel and sorters alike, although it did not affect final grades. We noticed also that there were only slightly more bruised cherries in the machine harvest than in the hand harvest.

Final grade of the mechanically harvested cherries of July 11 and 14 was C, both in the canned and frozen packs. The hand-picked cherries were also C grade in the canned pack on both dates, but A grade in the frozen pack.

In conclusion I would like to try to project something toward the future for mechanical harvesting of tart cherries. Bulk handling in water with the use of ice water or chilled water as soon as the cherries are removed from the tree in order to preserve the quality of the cherry is a MUST with the grower.

At the present time there does not appear to be an affective means of sorting cherries in the orchards. With the amount of defective cherries which are harvested mechanically, because all of the cherries on the tree are shaken off and collected, this poses our biggest problem. As with this work this year or any year, we are always faced with problem of the human element. We know from past experience that with cherries grading 90 percent U. S. D. A. and below, it is impossible for people who work on sorting belts to pick out enough defective cherries and run enough production to maintain a good quality product.

The electronic sorter for cherries appears as a distinct possibility for sorting cherries in the plant, with the possibility of sorting out defective cherries proving to be nearly 100 percent effective, and also maintaining production within the plant.

With the investment by processors for this equipment, plus the investment for bulk handling, water scales, etc., plus the investment by the grower for mechanical equipment and cooling equipment, machine harvesting of tart cherries is on the threshold of becoming a reality.

THE QUALITY OF HAND PICKED AND MECHANICALLY HARVESTED PROCESSED RED CHERRIES

By C. L. Bedford
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The quality of canned and frozen red cherries obtained from eight random lots for each method of harvesting was studied. Mechanical harvesting was done with a Friday impulse tree shaken and hand operated frames. The

fruit was transported to the laboratory and soaked in 45° F. running water for 4 to 5 hours before sorting, pitting and processing. Records were kept on the amount and type of cullage, pit loss, juice loss and yield of pitted fruit and drained weight, firmness and quality of the canned and frozen cherries.

The amount of cullage for the mechanical harvested fruit as presented in Table 1 averaged 3 per cent more than for the hand picked fruit. This was primarily due to excessively bruised fruit. In addition, the mechanical harvested fruit had about 1 percent attached stems, the removal of which almost doubled the sorting time. Delaying the harvest 10 days more than doubled the amount of cull fruit. Most of this increase was due to the presence of decayed and withered fruit.

The juice loss during pitting was similar for both methods of harvesting. However, the juice loss was about one percent greater in the cherries picked on July 19.

The yield of processed fruit from mechanical harvesting was about 3 per cent less than that of hand picking. This difference was considerable less than that obtained in 1961, when a 15 percent difference was found between the two methods.

The examination of the canned and frozen cherries showed slightly higher drained weights for the mechanical harvested fruit, Table 2. These differences, although not significant, indicated that bruised cherries from mechanical harvesting had more insoluble solids and less soluble solids than hand picked fruit.

The firmness, as measured with a tenderometer, was higher for both canned and frozen cherries of the mechanical harvest. This would be anticipated from the drained weight data and indicated a greater disintegration of the cherry flesh. The breakdown of the fruit was also indicated by the fact that there was a greater diffusion of color from the fruit to the sirup in the mechanical harvested cherries than in the hand picked fruit.

In conclusion, we feel that considerable improvement has been made in mechanical harvesting the past year. With continued improvement in the equipment to reduce the amount of bruising during harvesting and handling, the quality of the fruit delivered to the processing plant can be as good as that hand picked. However, one other major problem needs to be solved and that is the elimination of attached stems. If the processing plant is operated at peak efficiency and to pack the fruit at is opimum maturity, it can not be handicapped by the extra time required to remove stems.

TABLE 1. *Cullage, Juice Loss and Yield of Red Tart Cherries Harvested Mechanically and by Hand—East Lansing, 1962*

	Harvest Date	Hand Picked	Mechanical Harvest
Cullage (per cent)	July 9	3.5	5.1
	July 19	9.0	12.4
Juice loss (per cent)	July 9	7.0	6.7
	July 19	8.3	7.9
Yield (per cent)	July 9	79.4	77.0
	July 19	73.5	70.5

Canned fruit		
Drained weight (per cent)	89.5	89.8
Firmness, lb./sq. in.	13	14
Frozen fruit		
Drained weight (per cent)	93.7	94.5
Firmness, lb./sq. in.	39	43
Color* of sirup using the Absorption method	1.17	1.57

*Measurement of color made with Evelyn Colorimeter.

SOUR CHERRY TREES SHOULD BE PRUNED FOR EFFICIENT MACHINE HARVESTING

By R. Paul Larsen
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It is generally agreed that mechanical harvesting of sour cherries has moved ahead considerably in the past year or two. Much has been done to remove and handle the fruit rapidly and efficiently with a minimum of fruit injury. We have also learned a great deal in how to handle the equipment so that excessive injury does not occur to the trees. We still have much to learn, however, regarding the possible long term effects of mechanical shaking on branches and roots. These factors plus tree training, spacing and orchard management will receive considerable attention from horticulturists in future years.

It appears that one of the most obvious needs for efficient mechanical harvesting of sour cherries is to prune the trees to fit the harvesting operation. Most present-day mature sour cherry trees are almost unequaled in their lack of suitability for mechanical harvesting. Many low branches, excessive scaffold branches, and too much interior growth impede movement of equipment, ease and speed of shaking, and contribute to excessive tree and fruit injury.

These trees can be pruned to facilitate mechanical harvesting without sacrificing yields. At our Horticulture Farm, Michigan State University, a cooperative study with Horticulture, Food Science and U. S. D. A. Agricultural Engineering was initiated in 1961 on mature sour cherry trees to determine long term effects of pruning fungicide treatments and mechanical harvesting on the trees and fruit. Three pruning treatments were established using a total of 96 trees. The pruning treatments were:

(1) conventional pruning as for hand harvesting, i.e. light thinning out of excessive growth.

(2) moderate adaptive pruning for mechanical harvesting; primarily, removal of small branches near the ground level and in tree centers.

(3) heavy adaptive pruning for mechanical harvesting; removal of small branches and excessive growth near ground level and in tree centers plus reduction of major scaffolds to an average of 3 per tree.

Half of the 96 trees were hand harvested; half were machine harvested using an inertia shaker and "standard" cherry catching frames.

The results for 1961 and 1962 were quite similar and were as follows:

1. Fruit recovery of mechanically harvested trees was 17 percent less than hand picked trees. Considerable fruit was left on the machine harvested trees, but particularly on the trees that were not pruned for mechanical harvesting.

2. Heavy adaptive pruning reduced the yields of hand picked trees about 11 percent, but the fruit recovery of the machine-harvested, heavy-pruned trees was 12 percent greater than the machine harvested, conventionally pruned trees. Fruit that remained on conventionally pruned trees was mainly on small branches that could not be shaken adequately and on outside willowy hangers where the fruit simply "danced" from the shaking but did not come off. Also, late maturing fruit on inside, weak wood remained on the tree. The average combined yields of the two years, 1961-1962 for the pruning treatments are shown in the following table.

Average Yield, pounds/tree, 1961-1962

	Conventional pruning	Moderate adaptive pruning	Heavy adaptive pruning	Average
Hand picked	168	167	149	161
Machine harvested	124	135	139	133
Average	146	151	144	.....

As shown in the table, it is also evident that when the trees were heavily pruned for mechanical harvesting, there was little difference in recovered yields between hand picking and machine harvesting. In fact, in 1962, the heavy-pruned trees which were machine-harvested yielded an average of 10 pounds more per tree than the heavy-pruned hand-picked trees.

The ease and speed of mechanical harvesting were also increased very appreciably by the pruning. Catching frames were quickly moved under and away from the trees. The shaking boom was moved rapidly and easily into and out of open trees when only two or three shaker attachments had to be made. And, there was little branch injury where the shaker could clamp onto a branch in a straight-on (perpendicular) manner rather than be forced into an awkward attachment because of too many interfering branches.

These factors alone of increased speed and efficiency and reduced possibility of branch injury, make pruning for mechanical harvesting a *must* rather than just a desired practice.

Many growers in Michigan and other areas are pruning their trees for efficient mechanical harvesting. The best way to do it depends on the orchard, the equipment used, the pattern of harvesting, and individual grower preferences. Even each tree within an orchard may need different pruning to best adapt it for the machine age. However, certain fundamentals need to be considered for all mature sour cherry trees which have been

grown for hand harvesting, but are to be converted to machine harvesting. Thus, the following suggestions are offered:

1. Remove any branches which impede the movement of the catching equipment into or past the tree or against the tree trunk. Usually, branches that originate lower than three feet from the ground will be too close to the ground when loaded with fruit at harvest time.

2. Reduce the number of permanent scaffold branches so the tree can be harvested with 2 to 4 attachments of the shaker. Three scaffolds are probably best.

3. Cut out minor scaffold branches and other weak interior wood. A grower cannot afford to separately shake branches which bear only 10 to 15 percent of tree's crop. Also, this type of growth greatly interferes with the vision of the shaker operator and the movement of the shaker into a tree.

4. The "shaker" branches should be thinned out for easy attachment of the claw or clamp, and enough so that attachment need not be made on the same spot each year.

5. Willowy "hangers" on the outside of old trees may need to be removed or cut back so that fruit will be borne on "stiff" wood that can be shaken easily.

A properly pruned tree will probably look too open to you; however, at harvest time you will be pleased both with the ease of harvest and the amount of fruit the tree will yield.